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Department of Energy

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DEC 19 1997

DOE-0281-98

Mr. James A. Saric, Remedial Project Manager
U.S. Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT FINAL BASELINE REMEDIAL STRATEGY REPORT, REMEDIAL DESIGN FOR AQUIFER RESTORATION

References: 1) Letter from Schneider to Reising, "DOE FEMP Comments: Draft Final BRSR for the ARP Approval: RAWP for ARP," dated May 15, 1997.

2) Letter from Saric to Reising, "Baseline Remedial Strategy Report," dated May 22, 1997.

This letter serves to submit the subject responses for your review and approval. The comments were provided in Reference 1 listed above. The responses are being submitted at this time in order to formally document the resolution of the Ohio Environmental Protection Agency (OEPA) comments.

As agreed to by the OEPA and DOE at the October 1, 1997, meeting held at Fernald, these comments are addressed in the enclosure comment response document and by the groundwater model upgrade which is currently ongoing. Therefore, since the Baseline Remedial Strategy Report has been finalized, based on the U.S. Environmental Protection Agency (U.S. EPA) approval as documented in Reference 2, the document will not be re-issued.

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Should you have any questions regarding this submittal, please contact John Kappa at (513) 648-3149.

Sincerely,

Johnny Reising

FEMP:Kappa

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosure: As Stated

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RESPONSES TO OEPA COMMENTS ON THE DRAFT FINAL BASELINE REMEDIAL STRATEGY REPORT FOR THE AQUIFER RESTORATION PROJECT FOR APRIL 1997

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

DECEMBER 1997

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT FINAL BASELINE REMEDIAL STRATEGY REPORT FOR THE AQUIFER RESTORATION PROJECT APRIL 1997

General Comments

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section #: Pg #: Line # Code: C
Original Comment #: 1

Comment: The chemical processes active at the site are more complicated than can be described through a Kd approach, which assumes a linear isotherm and equilibrium. It is very likely that neither of these assumptions are met. Using the Kd approach to provide a retardation mechanism for modeling the migration of a plume from a source is commonly done. However, the applicability of this approach for evaluating removal of contamination is very questionable, because of the different modes of occurrence of a contaminant in the substrates, or through different bonding mechanisms. It may also be present in the aqueous phase, but in low-permeability material. Its removal from the system would then be controlled by aqueous diffusion rather than through advection. For these reasons, we consider that use of the model to support the present decision to pursue a more active remediation of the system is appropriate, but that other potential uses of the model would require a reanalysis of the appropriateness of the model.

Response: DOE agrees that the chemical processes active at the site are more complicated than can be described through a Kd approach which assumes a linear isotherm and equilibrium. However, with the current SWIFT modeling code, the options for modeling Kd are limited to either linear or Freundlich isotherm assumptions. A regression analysis of desorption batch test data, performed for the Operable Unit 5 Feasibility Study (Table F.8.IV-6 from the OU5 FS), resulted in a Kd of 17.8 L/Kg assuming a linear isotherm. When a regression was performed on the same data under a Freundlich iostherm assumption, a K of 110 L/Kg resulted.

SWIFT modeling using the Freundlich isotherm of 110 L/Kg predicted no change in the total uranium plume size or shape after ten years of pumping under the selected remedy. This prediction contradicts the reduction in plume size and concentration which has been observed in the South Plume area during the last four years that the South Plume Removal Action system has been operating. Therefore, the Freundlich isotherm assumption is the least favorable of the two isotherm choices available in SWIFT and a linear isotherm was chosen with a desorption Kd of 17.8 L/Kg.

As explained in Appendix A because SWIFT allows only a single Kd value, the modeling code was run with two different Kd values. After SWIFT was run in the early years of the scenarios with a Kd of 1.78 L/Kg, to simulate the adsorption phase of contaminant movement, the mass was redistributed to the solid phase from the liquid phase and the subsequent model runs for the later scenario years were made with the 17.8 L/Kg desorption Kd value.

Given these limitations in the SWIFT model code, DOE is in the process of upgrading the groundwater model to run on a code which will allow non-uniform and non reversible Kd values in the model. A kick-off meeting with the subcontractors performing the work to upgrade the model was held at the site on October 23, 1997. U.S. EPA and Ohio EPA and their respective subcontractors were invited to the meeting where the modeling upgrade process was reviewed. DOE received agency input to the modeling upgrade process and will periodically status U.S. EPA and Ohio EPA on the progress of the groundwater model upgrade project as significant contract deliverables are completed.

Action: Periodically status U.S. EPA and Ohio EPA on the progress of the groundwater model upgrade project as significant contract deliverables are completed. Details will be provided in meetings to be scheduled near the completion of the individual tasks comprising the model improvement scope.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section #: Pg. #: Line #: Code: C
Original Comment #: 2
Comment: The data on the behavior of the system during the remediation process should be collected to support future refinement of the model if modeling is to be used to support future decisions. It may be appropriate to designate a portion of the system for detailed data collection. Data on both contaminants and general inorganic chemistry need to be collected. Monitor wells at several points within the flow field should be installed to avoid the ambiguities that will result from mixing of waters of differing chemistries in extraction wells.
Response: Comment acknowledged. Section 3.0 of the Integrated Environmental Monitoring Plan details the sampling activities which will be done to track the progress of the aquifer remediation. Figure 3-19 of the IEMP illustrates the modeling performance process which will be followed. In addition, separate short term start-up plans for each module are also being prepared that outline additional sampling activities. Data on both contaminants and general inorganic chemistry will be collected. Additional monitoring wells will be installed if deemed appropriate. Modeling improvements are planned for the site groundwater model so that monitoring data can be rapidly used to update the model which will then be used to make predictions about future system performance. Details of this model improvement activity will be provided for agency review before the model is used for tracking or predicting aquifer remedy performance.
Action: Provide details of this model improvement activity for agency review before the improved model is used for tracking or predicting aquifer remedy performance. Details will be provided in meetings to be scheduled near the completion of the individual tasks comprising the model improvement scope.

Commenting Organization: OEPA Commentor: OFFO
Section 3.1 Pg. #: Line #: Code: C
Original Comment #: 3
Comment: The Ohio EPA agrees that the Operable Unit 5 ROD requires that remediation of the GMA is to continue until groundwater concentrations are below the FRLs although we believe that it is premature to mention a technical impracticability waiver. Considering the difficult and lengthy discussions held in regards to the soil certification process, we do not feel that it is too early to begin thinking through the process that will be used to verify the attainment of aquifer FRLs. We would like to begin the discussions now with some initial thoughts that will need to be considered.

- The OU5 ROD states that the remedy will "extract[ion of] contaminated groundwater until such time as final remedial levels are attained at all points in the impacted areas of the Great Miami Aquifer". This implies the development of a network of "attainment verification" monitoring wells that would be used in conjunction with the system of extraction wells to evaluate the attainment of the FRLs. The use of the phrase "at ***all*** points" (emphasis added) is unambiguous but for practical reasons only a limited number of verification points will be possible.

- A "toolbox" of statistical methods to evaluate the data and a set of statistical confidence intervals that both give the regulators confidence in the attainment while at the same time being realistically attainable for DOE.

- Provisions to monitor for rebound effects for a period of years after pumping has stopped in a given module. The costs associated with this monitoring and also the costs associated with keeping the pump and treat infrastructure in place while waiting to evaluate whether rebound is occurring should be considered. Some of the literature indicates that five years is necessary to confidently eliminate rebound as a concern.

Response: DOE agrees that initial discussions should begin in the near future on how FRL attainment will be measured as the aquifer remedy progresses.

Action: Begin initial discussions on how FRL attainment will be measured as the aquifer remedy progresses. These discussions could be scheduled as part of the IEMP quarterly meetings beginning in 1998, after the South Plume Optimization, South Field Extraction System and the Re-Injection Demonstration Modules come on-line.

Specific Comments

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 1.3.2 Pg. #: 1-8 Line #: 1-3 Code: C
Original Comment #: 4

Comment: Only linear, equilibrium sorption has been evaluated rigorously in the sensitivity analysis using the newly delineated plume. Effects of hydraulic properties of the aquifer and other geochemical processes (ionic effects, etc.) have not been quantified for the most recent model runs; wording in this section should reflect that.

Response: This comment is similar to Comment 1. Please see response to Comment 1.

Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: DDAGW
Section 3.1.5, 5.2.1.3 Pg. #: 3-4, 5-13 Code: C
Original Comment #: 5

Comment: It is important to acknowledge that resource damage liabilities are an issue, however, it is not appropriate to interpret the State of Ohio groundwater antidegredation requirements in this document. This legal issue will have to be worked out between the appropriate representatives from US EPA, Ohio EPA, and DOE in the future. Ohio EPA is not willing to accept DOE's interpretations at this time without the involvement of all appropriate parties. Lines 24-28, page 5-13, section 5.2.1.3 should be removed from the document.

Response: The intent of the text was to acknowledge the issue.

Action: The subject lines have been deleted from the final document.

Commenting Organization: OEPA Commentor: DDAGW
Section 3.2 Pg. # 3-6 Line #; 14-17 Code:
Original Comment #: 6

Comment: "Incorporate lessons learned through the operation of the South Plume Extraction System..." is very vague. DOE needs to specify that they will actively investigate alternative well/system designs, then implement these changes.

Response: DOE agreed in the Operable Unit 5 ROD to investigate enhancement technologies to speed up the aquifer remedy. The Injection Demonstration project is an example of the application of such a technology. DOE continues to be committed to investigate and apply additional enhancement technologies as well as to incorporate lessons learned as the aquifer remedy proceeds. DOE believes it has demonstrated a good faith effort to this end and will continue to do so.

Action: Continue to investigate and apply additional enhancement technologies and incorporate lessons learned as the aquifer remedy proceeds.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 3.3.2 Pg. #: 3-7 Line: 23-24 Code: C
Original Comment #: 7

Comment: The reduction in iron content due to proposed treatment processes should be quantified. This may be particularly important in describing the long-term efficiency of injecting water into the aquifer and the impact of iron bacterial.

Response: Agree. The reduction in iron is anticipated to be such that the iron concentration in the water to be re-injected will be less than 0.1 ppm. Geochemical modeling conducted as part of re-injection testing indicates that, given the geochemical conditions of the GMA near the location where re-injection will be conducted, ferric iron precipitation has the potential to occur when iron concentrations greater than 0.15 ppm are present. The geochemical modeling to support this is located in Appendix F of the Phase II Southfield Injection Test Report For Operable Unit 5.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 3.4.4 Pg. # 3-11 Line: 6-28 Code: C
Original Comment #: 8

Comment: The conceptual model of sorption/desorption processes described in this section and in Appendix A needs to be reflective of the current understanding of these processes. Further, this description mixes up the concepts of nonlinear-sorption and time-dependent sorption. DOE has correctly identified that simple linear isotherm models typically do not fit observed contaminant behavior in aquifer systems (Line 11). However, the issue of reversibility of sorption with time is not pertinent to the site conditions; the kinetics of uranium desorption may likely be faster than groundwater flow rate past the aquifer media. It may be safe to assume that the contaminants have been in the aquifer system long enough to have established an equilibrium over the years.

The anticipated change in desorption behavior of uranium during remediation would actually be concentration-dependent, and not exactly time-dependent (time dependency is only secondary since concentration is decreasing with time). The approach adopted by DOE deals with this change in desorption behavior as separate linear isotherms in two time segments: (a) an early phase with high contaminant concentrations in water and relatively weak sorption (Kd=1.78 L/kg), and (b) a later phase with low contaminant concentrations in water and strong sorption (Kd=17.8 L/kg). These two phases are schematically shown as linear segments in Figure 1. However, the concentration-dependent sorption behavior is continuously changing with reducing uranium concentration. (Also see comments on Appendix A)

A mathematically rigorous approach for modeling continuously changing sorption behavior is to use a nonlinear isotherm, such as the Freundlich isotherm (Freeze and Cherry, 1979, Schwarzenback, 1993). Instead of using the two sorption regimes (represented by the two Kd values corresponding to only two points on a curve), a continuous mathematical function describes the entire range of sorption behavior expected during the plume recovery, as shown in Figure 1. Available groundwater flow and transport models (e.g., SWIFT, FTWORK) provide the capability of utilizing the Freundlich isotherm. The two parameters required for the Freundlich isotherm (K,n) can be estimated from the Feasibility study batch sorption data (DOE, 1995). Alternatively, these parameter values for a side range of contaminants are available in the literature.

Figure 1: Concepts of contaminant sorption onto aquifer media.

Because the effect of sorption on duration of cleanup to FRL has been shown to be very significant, DOE should consider using Freundlich isotherm for more realistic predictions. This approach will simplify the modeling procedures used in the BRSR (Appendix A) and appropriate time for switching from one Kd regime to another.

Response: This comment is similar to Comment 1. Please see response to Comment 1.

Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section 4.1.2 Pg. #: 4-3 Line: 1-7 Code: C
Original Comment #: 9

Comment: The discussion on geochemical processes should also focus on nonlinear sorption parameters (see comments on Section 3.4.4).

Response: This comment is similar to Comment 1. Please see the response to Comment 1.

Action: See the action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section 4.2.1 Pg. #: 4-4 Line 27-31 Code: C
Original Comment #: 10

Comment: The Kd transition results in a sudden decrease in aqueous concentrations of uranium in model predictions, resulting in a duration for cleanup to FRL of about one year after the transition. The duration for overall cleanup may be significantly different when a nonlinear sorption behavior is modeled.

Response: This comment is similar to Comment 1. Please see the response to Comment 1.

Action: See the action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section 4.2.3.3 Pg. #: 4-12 Line: 10-16 Code: C
Original Comment #: 11

Comment: A comparison of uranium mass removal in Tables 4-2, 4-4, 4-6, and 4-8 shows that mass removal becomes asymptotic only after a 10-yr operation in the 15-year scenario. All other scenarios show that uranium removal is still significant at completion of the scenario. This has implications for efficiency of each scenario in achieving FRL, and therefore, the relative mass removal under each scenario should be discussed as a subsection in Section 4.3. Further, the implications for a recurrence of concentrations above FRL should also be evaluated.

Response: The 10-year scenario has been selected as the preferred scenario for enhancing the FS base case (27-year) remedy; based on the overall acceptance of the 10-year scenario by DOE, the regulatory agencies, and other stakeholders as the preferred scenario, DOE does not see the need to further revise the Baseline Remedial Strategy report to further justify this agreed-to selection. DOE is committed to the model improvements for the future that have been discussed with EPA and Ohio EPA, and also is committed to the necessary adjustments in the remedy that may be necessary to accommodate actual performance data obtained from the field. It is recognized that the concentration "bounce-back" phenomenon will need to be watched for as the remedy nears completion, and this has been taken into consideration in the development of the FEMP's out year funding profile. The IEMP also recognizes this need.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section 4 Pg. # 4-26 Line: 31 Code: C
Original Comment #: 12

Comment: The sentence referenced in the indicated text is incomplete.

Response: Agree. The rest of the text for this sentence appears on page 4-28.

Action: The referenced text has been fixed in the Final BRSR so that the sentence is complete.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section 4 Pg. # 4-28 Line 2 Code: C
Original Comment #: 13
Comment: The referenced text is out of order; it appears to be a continuation of the sentence starting on Line 31 of Page 4-26.
Response: Agree.
Action: See action in response to Comment 12 above.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section 4 Pg. #: 4-33 Line: 23 Code: C
Original Comment #: 14
Comment: The attainment of the intended capture zones during remediation should be verified with water level data collected from the site monitoring well network. A Figure should be provided showing the wells used for this purpose and the predicted capture zone.
Response: Water level data will be collected from a network of monitoring wells as outlined in Section 3.0 of the Integrated Environmental Monitoring Plan. The network of groundwater monitoring wells to be used for water level measurements was presented on Page 3-49 of the IEMP (See Figure 3-13).
Action: None necessary.

Commenting Organization OEPA Commentor: HSI GeoTrans, Inc.
Section: 5.1.1 Pg. #: 5-2 Line: 20-26 Code: C
Original Comment #: 15
Comment: Because significant differences were observed between the maximum plume and currently-measured plume, the same plume (i.e., the most recent plume) should have been used in all simulations. The only exception may be the simulation runs performed for particle tracking purposes.
Response: Since work on the Baseline Remedial Strategy Report has been ongoing since mid 1996, and since the most recent plume delineation was not completed until April 1997 with completion of the Geoprobe™ sampling, timing did not allow all of the modeling to use the same (i.e., most recent) plume. Since the early model work for the report was done to compare the relative costs and efficiencies of the 25 year plan, the 15 year plan, the 10 year plan, and the 7.5 year plan, these scenarios do not need to be modeled again with the most recent plume as the relative comparisons would give the same result. As agreed to with US EPA and Ohio EPA, once the 10 year plan was chosen as the best scenario, it was run with the most recent plume data as presented in Section 5.0 of the report.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5.1.1 Pg. # 5-3 Figure: 5-1 Code: C
Original Comment #: 16
Comment: The figure is very hard to comprehend in terms of separately visualizing the kriged plume and the synthetic maximum plume. A better presentation should be presented.
Response: DOE will incorporate this suggestion in future presentations/followup documents, if (or when) both plumes are needed for the presentation.
Action: As noted in the response.

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Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5.2.1 Pg. # 5-9 Line: 4 Code: C
Original Comment #: 17
Comment: Off-property cleanup times may change for the different scenarios when nonlinear sorption is used.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5.2.1.3 Pg. # 5-13 Line: 30-35 Code: C
Original Comment #: 18
Comment: Because the property owner has agreed to locating wells 1, 2N and 3N along the property boundary, and since such well locations have shown promising results, the discussion of RCRA regulations doe not appear pertinent.
Response: Comment acknowledged.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5 Pg. # 5-38 Line: Code: C
Original Comment #: 19
Comment: The text indicates that adjustments to extraction and injection well pumping rates may be required because of wastewater plant treatment capacity reductions resulting from temporary storm water influxes and remediation wastewater needs. What is the anticipated duration of reduced capacity? The text also indicates that computer modeling will be used to determine the optimal pumping rates to meet the reduced flow requirement. Please provide additional detail regarding the implementation of this process. Will the model runs be conducted a priori for anticipated flow reductions or when the actual amount of the reduction is known?
Response: Yearly treatment volumes available for groundwater were based on the capacity of the dedicated groundwater treatment systems (AWWT expansion and SPIT) and the excess treatment capacities remaining after treatment of an average year's expected rainfall/runoff. During and immediately following specific rainfall events, reduced treatment capacity for groundwater will occur as storm water runoff is treated preferentially instead of groundwater because of its higher uranium contamination content. During these intervals, the amount of groundwater bypassed directly to the river will have to be increased or, if this is not possible without exceeding the 20 ppb outfall limit for total uranium, pumping may have to be reduced at selected wells. However, the inverse is also expected (i.e., times when little or no stormwater runoff is available for treatment and more than the expected average treatment for groundwater is available). During these times, the pumping rates of some wells will be increased above their normal flow. Over the course of the ten year clean up, the above factors are expected to average out to the flow rates presented. The decision as to which wells to turn off during excessive stormwater/runoff times or which wells will be increased above normal extraction rates during low stormwater/runoff periods will be based on the measured uranium concentration data from the extraction wells and the past extraction history of the wells. Further details and explanation of this is presented in the Operations and Master Maintenance Plan (OMMP) for the Aquifer Restoration and Wastewater Treatment Project (ARWWP).

If reduced treatment capacity for groundwater occurs due to excess remediation wastewater, and if this reduced capacity appears to be long term (i.e. on the order of years), then the groundwater pumping rates derived from modeling in support of the Baseline Remedial Strategy may have to be adjusted to free up the required capacity and/or additional treatment capacity may need to be added. If an adjustment to pumping rates becomes necessary, the groundwater model will be used to predict the long term effect on the remedy performance

using the adjusted pumping rates and subsequently to determine the need for additional treatment capacity.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5 Pg. #: 5-38 Line: Code: C
Original Comment #: 20

Comment: A comparison of the maximum sampling depth at each Geoprobe™ location to the estimated top of bedrock should be provided for each Geoprobe™ location. The comparison of these two depths will enable the assessment of the thickness of unsampled aquifer at each Geoprobe™ location.

Response: Each Geoprobe™ location was sampled through the vertical plume profile until total uranium concentrations beneath the plume were at or near background. This was done to ensure that the entire vertical extent of the plume was sampled. Since monitoring data from Type 4 wells shows no deep contamination in the Great Miami Aquifer, no attempt was made to sample to bedrock. The aquifer in the area where the Geoprobe™ samples was taken is approximately 150 feet in thickness and is fairly uniform in thickness since the sampling area is about in the center of the New Haven Trough.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5.4.4.3 Pg. #: 5-39 Line: 12-18 Code: C
Original Comment #: 21

Comment: Model simulations using the Insufficient Treatment Performance Mode should be performed to estimate its potential effect on duration for complete remediation. Such simulations should be a part of the sensitivity analysis in Appendix F.

Response: This comment is similar to Comment 19. Please see response to Comment 19.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 5 Pg. #: 5-40 Line: 12 Code: C
Original Comment #: 22

Comment: A summary of data collection during operation of the groundwater remedy should be provided. The statistical approach for evaluating these data should also be summarized. The text should also refer the reader to a detailed discussion of the statistical approach that should be provided in the Integrated Environmental Monitoring Plan (IEMP).

Response: As noted in the third paragraph on page 5-39 (last paragraph on page 5-37 of the final BRSR) the IEMP provides the data collection and evaluation procedures for continuous performance assessment and system improvement. As noted in the response to Comment 3, meetings to discuss methods of measuring FRL attainment during remedy performance will likely be scheduled in 1998 as part of the IEMP quarterly meetings.

Action: Schedule meetings with OEPA in late 1998 to discuss methods of measuring FRL attainment during remedy performance.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.2.0 Pg. #: A-2 Line: 19-21 Code: C
Original Comment #: 23

Comment: The alternative view provided by Freundlich-type isotherm concept is that as contaminant concentration (and mass) in the system decreases, desorption becomes relatively more "difficult." (See comments on Section 3.4.4).

Response: This comment is similar to Comment 1. Please see response to Comment 1.

Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.2.0, A.4.0 Pg. #: A-2, A-4 Line: 9-18, 32-12 Code: C
Original Comment #: 24
Comment: The authors' theoretical arguments that: (1) the adsorption process is dominated by physical sorption, (2) desorption process is dominated by chemisorption, and (3) that a transition from physical sorption to chemisorption occurs upon aging is not supported by data at the site. The only reference to the scientific literature is to an early paper by Lasaga (1981), which only addressed physical sorption and chemisorption on general terms, and those on sorption mechanism of organic molecules. In light of the lack of any work, at the site or somewhere else, on uranium sorption mechanisms, these theoretical arguments are speculative. The discussion gives a misleading impression that an understanding of uranium sorption mechanism at the molecular level is reached. This part of the report should clearly acknowledge the lack of understanding of uranium sorption mechanism.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.2.0, A.4.0 Pg. #: A-2, A-4 Line: 9-18, 32-12 Code: C
Original Comment #: 25
Comment: The authors also believe that uranium desorption is kinetically more inhibited than adsorption. Although this general concept is shared by some, from their experiences of bulk property measurements (Kd measurements) and field work, this concept is nevertheless unproven for the site. The comparison of adsorption Kd with desorption Kd cited in the report is not a good evidence for slow desorption kinetics. This "adsorption" Kd of 1.78 ml/g is a fitting parameter from the calibration of past uranium transport that resulted in the present plumes and/or from the lower end of the range of Kds calculated from paired soil and water samples. The "desorption" Kd of 17.8 ml/g was determined from linear regression of solid phase and liquid phase concentrations of uranium from the batch experiments in the laboratory. It should be noted that laboratory Kds seldom agree with field-based Kds. Typically, laboratory-measured Kds are higher than field-measured Kds. Differences such as soil-to-water ratios can result in Kd values that are different by orders of magnitudes. Therefore, the differences in the values of the two types of Kd may well be artifacts. It should be noted that a wide range of Kd values was determined in the batch experiments (from 7 to 1307).

The results of the sequential batch experiments on acid leaching of contaminated top soils are not good evidence for Kd transition either. These experimental conditions are significantly different from the conditions in the GMA on many fronts. In short, slower desorption kinetics is a reasonable, but unproven assumption.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.3.2 Pg. #: A-4 Line: 9-18 Code: C
Original Comment #: 26
Comment: A discussion of FTWORK should also be included in "Simplified Models". Further, a comparative discussion of linear versus non linear sorption models is warranted, which should focus on implications of using these modeling approaches for predicting duration of remediation.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.4.0 Pg. #: A-5, A-6 Line: 26-23 Code: C
Original Comment #: 27

Comment: With the assumption that adsorption and desorption kinetics are different at the site, the use of the "Kd transition" approach to modeling the different kinetics of adsorption and desorption processes is inherently inadequate, although it is understood that the modelers are limited by the modeling tools (SWIFT) available to them. The report should make clear that Kd approach does not address the kinetics issue, and the "Kd transition" approach is a simplification of the chemical system that may be adequate for some purpose but not others. The weaknesses of the Kd transition approach is obvious. For example, these can include: (1) the assumption of instantaneous equilibrium between soil particles and groundwater, which contradicts the underlying kinetic argument for desorption; (2) the abrupt redistribution of the mass at the transition; (3) the timing of the transition; and (4) the problems, which the authors discussed deftly in the Introduction, of using a Kd approach whether or not a transition occurs. As discussed elsewhere, the use of a nonlinear isotherm may be a better approach, but one that would still ignore kinetics.

Response: This comment is similar to Comment 1. Please see response to Comment 1.

Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.4.2 Pg. #: A-7 Line: 1-16 Code: C
Original Comment #: 28

Comment: The value of 17.8 ml/g for the desorption Kd should not be regarded as a firm number. First, Kd is only a conditional parameter. It is a measurement of bulk properties under a set of specific laboratory conditions, which may well be different to field conditions. For example, the water-rock ratios, pH, and grain sizes can be different in laboratory and field.

Second, a wide range of Kds was measured from the experiments. The linear regression that generated the number of 17.8 ml/g shows a poor correlation among the data (a R. of 0.411). Thus, there are some possible experimental flaws that might affect the results. During experiments, CO2 may be degassed if the atmosphere was not controlled to maintain the CO2 pressure. Groundwater taken from GMA has a partial CO2 pressure of 10-1.7 atm (IT, 1996), which is significantly higher than the atmospheric CO2 pressure of 10-3.5 atm. If degassing occurs, the solution pH would drift to higher values. Lower carbonate/bicarbonate concentrations and higher pH can both change uranium sorption behaviors. Research showed that uranium sorption onto clay and silica minerals is very sensitive to solution pH and carbonate contents (e.g., Lupowski and Pabalan, 1994).

Response: This comment is similar to Comment 1. Please see response to Comment 1.

Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.4.0 Pg. #: A-6 Line: 4-12 Code: C
Original Comment #: 29

Comment: The lack of kinetic considerations of the uranium transport in the model is a major omission of the transport model. Metal concentration rebound is commonly observed in many pump-and-treat systems. If desorption is kinetically inhibited, uranium can continue to be released from the soil surfaces after active remediation ceases, causing an increase in dissolved uranium concentrations. Rebound issues should be addressed prior to decision to end active remediation.

Response: Comment acknowledged. Since rebound would occur during the later years of the aquifer remedy after pumps have been turned off in areas where the FRLs have been achieved, and since no current evidence exists as to how significant the rebound effect will be in this aquifer,

DOE will address this issue in future revisions of the Integrated Environmental Monitoring Plan.

Action: DOE will address this issue in future revisions of the Integrated Environmental Monitoring Plan.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.4.1 Pg. #: A-6 Line: 25-35 Code: C
Original Comment #: 30
Comment: Using a Kd of 1.78 ml/g to establish the solid phase inventory may lead to an underestimate of the inventory.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.4.3 Pg. #: A-7 Line: 18-27 Code: C
Original Comment #: 31
Comment: The timing of the Kd transition, as the authors acknowledged, is highly uncertain. An area that may be worth more detailed work is the effects of changing the geochemical environment when pore waters are replaced with injected water of different chemistry. Studies have shown that uranium sorption onto clay minerals is strongly dependent on the solution pH, carbonate concentrations, and effective surface areas. The replacement or pore water by injection may change uranium sorption behavior so that "Kd transition" can occur but for different reasons. It may not be due to "aging".
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.4.2 Pg. #: A-7 Line: 9-23 Code: C
Original Comment #: 32
Comment: This discussion should be replaced by that for parameters of Freundlich isotherm, K and n.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.5.0 Pg. #: A-8 Line: 26-28 Code: C
Original Comment #: 33
Comment: The modeling approach will be simplified considerably as a result of using a nonlinear isotherm. The two-stage approach adopted in BRSR will not be required and Steps 2 through 6 will be eliminated. It should be pointed out that this will also reduce the uncertainty associated with describing each individual plume, assigning the appropriate Kd value and guessing the time for transition from the first Kd regime to the second.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: A.6.0 Pg. #: A-10 Line: 7-19 Code: C
Original Comment #: 34
Comment: Post-remediation rebound can also be a result of heterogeneity of the aquifer. The GMA is composed of glacial sand and gravel deposits. The diffusion of uranium from less permeable parts of the aquifer to more permeable parts of the aquifer, or out of limestone clasts, may contribute to the re-emergence of a contamination plume.

Response: Comment acknowledged. Please see response to Comment 29.
Action: See action for Comment 29.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: E.1.3 Pg. #: E-2 Line: 17-19 Code: C
Original Comment #: 35
Comment: The five simulations performed using DMEPP plume should be revised using the most current, kriged plume to reflect a more realistic depiction of site conditions.
Response: This comment is similar to Comment 15. Please see response to Comment 15.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: E.2.2 Pg. #: E-4 Line: 38-42 Code: C
Original Comment #: 36
Comment: The modeling results for Plume Expansion and Efficiency may be significantly different if the most current plume were used, because concentrations and spatial extent are greater for the new plume delineation.
Response: This comment is similar to Comment 15. Please see response to comment 15.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: E.3.2 Pg. #: E-6 Line: 34-35 Code: C
Original Comment #: 37
Comment: A more detailed discussion should be provided regarding the probable causes for the downward plume expansion when injection is performed at lower levels.
Response: The text in question states that "...it was concluded that injection at lower elevations can reduce downward plume expansion." In the modeled case where injection was at a lower level, the induced vertical gradient was below the plume and no vertical expansion of the plume occurred. This is contrasted with the model simulations where injection occurred at shallower levels above the plume. The induced vertical gradients above the plume resulted in vertical plume expansion in the downward direction.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: E.4.2 Pg. #: E-12 Line: 3-5 Code: C
Original Comment #: 38
Comment: The comment about "minor differences" does not sound reasonable considering the significant differences in plume shape as well as the highest concentration within plume segments.
Response: Comparing Figures E-25 and E-26 shows that the initial plumes both have the same shape and areal extent. The off-property portion of the plume in Figure E-25 has higher concentrations (just over 200 ppb) in the central portion than does the plume depicted in Figure E-26 (between 100 and 200 ppb). Given these differences, DOE does not believe that the conclusions reached and outlined in this section would change if the same plume was used for all scenarios. The different plume interpretations utilized in the various steps of the modeling in support of the BRSR were a result of the progressive findings of the Geoprobe™ sampling, which occurred concurrently with the modeling. This was discussed with US EPA and Ohio EPA in March 1997. It was DOE's understanding at that time that the EPAs concurred with the approach of using the progressive findings of the Geoprobe™ sampling as it became available rather than re-modeling all the earlier scenarios with the latest interpretations from the Geoprobe™ sampling.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: E.4.3.1 Pg. #: E-15 Line: 28-29 Code: C
Original Comment #: 39
Comment: The conclusion about cleanup by FY 2004 may change when nonlinear sorption processes are used in model simulations.
Response: This comment is similar to Comment 1. Please see response to Comment 1.
Action: See action for Comment 1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: E.4.3.3 Pg. #: E-17 Line: 38 Code: C
Original Comment #: 40
Comment: It is not obvious how the uranium plume was "very conservative", because it was based on actual Geoprobe™ data.
Response: Although the initial uranium plume referred to by the text was based on the Geoprobe™ sampling results, it is still considered to be conservative because of the way in which the Geoprobe™ results were interpreted to construct the initial model plume. The Geoprobe™ sampling results for total uranium along with the most recent total uranium data from the type 2 and type 3 monitoring wells was kriged with a 5 foot depth interval. When assigning initial concentrations to the groundwater model blocks the maximum total uranium concentration in any five foot thickness of the kriged model was used for the initial concentration in the groundwater model block. Since each layer of the groundwater model is significantly thicker than 5 feet, conservatism was maintained by assigning the maximum kriged concentration to the whole model layer.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: F.2.2 Pg. #: F-6 Line: 26-29 Code: C
Original Comment #: 41
Comment: This discussion of hydraulic parameters not significantly affecting cleanup time should be reflected in Section 1.3.2. It is obvious that only one parameter was evaluated in sensitivity analyses.
Response: As noted in Comment No. 11, the 10-year scenario has been selected as the preferred scenario, based on a number of factors and preferences. The uncertainty analysis presented in Section F.2.2 was just one of the factors considered. Because the selection of the preferred scenario is now complete, DOE does not see the need to further revise the Baseline Remedial Strategy Report to further justify or document the agreed-to decision.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-2 Line: 32 Code: C
Original Comment #: 42
Comment: The highest Phase I uranium concentration was measured at Geoprobe™ Location 12192 (331 up/L). Additional Geoprobe™ sampling should be conducted east of this point or the text should include a discussion of any existing documenting the position of the plume's leading edge.
Response: An additional Geoprobe™ sampling point was located east of 12192 in response to a previous OEPA comment. All the results were well below 20 ppb as reported in the final BRSR issued in June 1997.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-3 Line: 21-26 Code: E
Original Comment #: 43
Comment: Geoprobe™ location identifiers should be made consistent with Figure G-1. For example, 1231, 1232, 1233, 1234, and 1230 should be revised to 12231, 12232, 12233, 12234, and 12230.
Response: Agree.
Action: The Geoprobe™ numbers on page G-3 of the Final BRSR were corrected to be consistent with those shown in Figure G-1.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-4 Line: 1 Code: E
Original Comment #: 44
Comment: Revise location identifier 1231 to 12231.
Response: Agree.
Action: The Geoprobe™ location identifier 1231 in Line 1 of page G-4 was changed to 12231 in the final BRSR.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-4 Line: 14-24 Code: C
Original Comment #: 45
Comment: Additional Geoprobe™ sampling should be conducted to define the extent of the plume east of 12234 and 12235.
Response: DOE does not think that additional Geoprobe™ data in the area in question is required to support remedial design for the following reasons:

- The Geoprobe™ sampling at location 12234 (Table G-12) shows a maximum total uranium concentration of 53 ppb at 20 feet below the water table. Since the samples at 10 feet and 30 feet below the water table had total uranium concentrations of 1.7 and 2.4 ppb respectively, this location is interpreted to be very near the 20 ppb edge of the total uranium plume. (See the profile display in Figure G-15).

- The existing four South Plume Extraction wells are influencing the groundwater flow to the degree that they are "capturing" the groundwater in the area of Geoprobe™ locations 12234 and 12235. This is based on modeled and interpreted (from actual groundwater elevation measurements) groundwater flow directions in the area in question.

- The initiation of pumping of the two new South Plume Optimization Wells in 1998 will further increase the eastern extent of the capture zone in the area in question.

However, at some time in the future it may be necessary to conduct Geoprobe™ sampling in the area in question to ensure that remediation is complete. Groundwater remedy certification sampling will be defined in a future version of the IEMP.
Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-5 Line: 32 Code: C
Original Comment #: 46
Comment: Hydropunch data is used to define the leading edge of the plume at some locations. When was the Hydro punch data collected and what justification exists that these data are reflective of current plume conditions?

Response: The text in question refers to Hydropunch data collected during the installation of the Southfield extraction wells which are not located at the leading edge of the South Plume. In general, vertical profile sampling results utilizing the Hydropunch technique were used in the past to assist in technically defensible placement of well screens in both South Field extraction wells (1995-1996) and in RI/FS monitoring wells installed in 1993. DOE is aware of only one area where 1993 hydropunch data helps to define the leading edge of the South Plume. This is in the area of Monitoring Wells 2881/3881 just to the north of and entrenched within the capture zone created by South Plume Recovery Well 4.

As noted in the above response to Comment 45 DOE does not think that additional Geoprobe™ work to the east of locations 12234 and 12235 (in the vicinity of Monitoring Wells 2881/3881) is warranted to support remedial design. However, at some time in the future it may be necessary to conduct Geoprobe™ sampling in the area in question to ensure that remediation is complete. Groundwater remedy certification sampling will be defined in a future IEMP.

Action: No revision to the BRSR required.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-7 Line: 7 Code: E
Original Comment #: 47

Comment: The referenced text should be revised to read "the cross section illustrates how the total uranium plume appears to be migrating..."

Response: Agree.

Action: The error was corrected in the final document.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: G Pg. #: G-8 Line: 21 Code: C
Original Comment #: 48

Comment: Homeowner well pumpage is stated to be impacting plume movement near well 12228. The maximum concentration at this point is 70 up/L. Is the residential well used for potable supply?
If so, does the threat of exposure to uranium contamination exist?

Response: The homeowner in question is on the recently completed public water supply system so the well is not used as a potable water supply. Prior to public water supply, the homeowner was supplied with an ion exchange system for uranium removal prior to water usage. The system was installed and maintained by the DOE.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 4.2.5.1 Well field Pattern Pg. #: 4-22 Line: 6 Code: C
Original Comment #: 49

Comment: The 7.5 year scenario is described as including three horizontal wells in the south plume area installed using the Ranney method. However in Table 4-7 and Figure 4-4, only two horizontal wells are present in the south plume area. The costs seem to include the third well. What is the correct configuration? Were two or three wells included in the model used to calculated the cleanup period? Please address the discrepancy.

Response: For the 7.5 year scenario, three Ranney wells were used in the South Plume/South Field area with the well header assumed to be onsite near Re-injection well 8. These three wells are designated D, E, and F in Figure 4-4 and in Table 4-7. The referenced text should have referred to three Ranney wells in the South Plume/South Field area.

Action: In the final BRSR the sentence starting on line 5 of page 4-22 was changed to read: The Ranney approach was selected for installing the three horizontal wells located in the South

Plume/South Field area, because the overburden is considered clean and higher pumping rates are required in this area.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 4.3.2 Implementing Risk and Uncertainty Pg.#: 4-30 Code: M
Original Comment #: 50

Comment: In this section, DOE has addressed uncertainty of success, or the causes of uncertainty for the groundwater remediation scenarios for OU5. This section needs to include a discussion of the uncertainty in the prediction of cleanup times for each given remediation scenario. What impact will this uncertainty have on the final selection? It should be noted that the shorter time frame scenarios are loaded with capital costs up front, and O&M costs are reduced due to the shortened operation time frame. What happens to the cost if the remediation is not complete in the predicted time frame of the remediation scenario? Two tables showing the costs of possible scenarios for the extension of the 10-year and 25-year scenarios are listed below.

As can be seen on the tables, the total present worth cost of remediation if the 10-year scenario is extended by 10 years is essentially the cost of the 25-year scenario. The cost of extending the 25-year scenario by 10 years is only half that of extending the 10-year scenario by ten years. The object of this evaluation is to demonstrate that the cost advantage of the shorter term scenarios will diminish if the remediation is not completed within the estimated time frame. The uncertainty of the remediation time frame is important, and should be addressed in this section.

Response: As noted in other comments, the preferred scenario selection process is complete, and the 10-year scenario has been selected as the preferred approach by the parties involved. DOE does not see the need to revise the Baseline Remedial Strategy Report further, as a means to further justify or document the agreed-to selection of the 10-year scenario, or to further discuss the uncertainties associated with the preferred approach.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 4.3.1.2 Scenario-Specific Relative Cost Pg. #: 4-17 Line: 4-6 Code: C
Original Comment #: 51

Comment: When calculating the present worth cost of the four alternatives, the cost of wells installed in the future should be converted to present worth dollars. It appears the costs were assumed to be incurred at year 0. This does not change the outcome (10-year scenario is the most cost effective) of the cost comparison, however it does impact the long term scenarios more than the short term scenarios.

Response: DOE acknowledges the comment. As the commentor correctly points out, incorporating future wells installed with present worth dollars does not change the result of the comparison so the results would be the same.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 4.3.2.2 Treatment Efficiency and Capacity Pg. #: 4-31 Code: C
Original Comment #: 52

Comment: In costing the four remediation scenarios, it becomes apparent that the O&M costs of the groundwater treatment system are the largest cost items in all scenarios except for well installation in the 7.5 year scenario. The groundwater treatment system O&M costs account for 30% to 50% of the total present worth cost of the scenarios. Insufficient detail is given on how these cost estimates were made. The document should also contain or reference a discussion of the uncertainty of the O&M cost estimates.

Response: As noted in other comments, the preferred scenario selection process is complete, and the 10-year scenario has been selected as the preferred approach by the parties involved. DOE does not see the need to revise the Baseline Remedial Strategy Report further, as a means to further justify or document the agreed-to selection of the 10-year scenario, or to further discuss the uncertainties associated with the preferred approach.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: 4.3.2.2 Treatment efficiency and Capacity Pg. #: 4-31 Code: M
Original Comment #: 53

Comment: The four remediation scenarios were evaluated with the intent of optimizing groundwater extraction and injection rates to determine the most cost effective scenario. To find the most cost effective alternative the groundwater treatment O&M costs (30% to 505 of the present worth cost of the alternatives) should also have been considered a variable to be optimized. It would seem that the assumption that groundwater treatment costs are independent of the flow rate is not appropriate. The cost estimate for each scenario should include an estimate of base cost items such as administration, labor, and facility maintenance, and then costs such as treatment chemicals and utilities calculated on a per unit flow rate basis. This level of detail is required to determine the most cost effective alternative.

Response: As noted in other comments, the preferred scenario selection process is complete, and the 10-year scenario has been selected as the preferred approach by the parties involved. DOE does not see the need to revise the Baseline Remedial Strategy Report further, as a means to further justify or document the agreed-to selection of the 10-year scenario, or to further discuss the uncertainties associated with the preferred approach.

Action: None necessary.

Commenting Organization: OEPA Commentor: HSI GeoTrans, Inc.
Section: Table 4-11 Summary of Present Worth Analysis Pg. #: 4-30 Code: C
Original Comment #: 54

Comment: It would be better to present the data in Table 4-11 as a graph, similar to the one below. The data used in this graph are from the cost estimates we compiled using DOE's scenarios and unit costs, however we converted future costs to present costs for all wells installed in the future. From this graph, two things become apparent. The 10-year scenario is the most cost effective (as DOE has established) and secondly, the difference in present worth costs diminishes significantly as the discount rate changes from 0% to 5%. This should be discussed in the text.

Response: As noted in other comments, the preferred scenario selection process is complete, and the 10-year scenario has been selected as the preferred approach by the parties involved. DOE does not see the need to revise the Baseline Remedial Strategy Report further, as a means to further justify or document the agreed-to selection of the 10-year scenario, or to further discuss the uncertainties associated with the preferred approach.

Action: None necessary.